DESCRIPTION

WORN ARTICLE AND METHOD FOR PRODUCING THE SAME

TECHNICAL FIELD

[0001] The present invention relates to a worn article and a method for producing the same.

BACKGROUND ART

[0002] The first to fourth patent documents, identified below, disclose worn articles, such as disposable diapers and underpants, that are stretchable in the around-the-torso direction, and methods for producing the same.

[First Patent Document] Japanese Laid-Open Patent Publication No. 10-286279

[Second Patent Document] Japanese Laid-Open Patent Publication No. 7-80023

[Third Patent Document] Japanese National Phase PCT Laid-Open Publication No. 2000-500684 (WO97/47265)

[Fourth Patent Document] Japanese National Phase PCT Laid-Open Publication No. 2000-510349 (WO96/03952)

[0003] The first patent document discloses a worn article having a stretchable side panel, which includes an extensible sheet and an elastically stretchable hot-melt adhesive.

The second patent document discloses a method for producing a worn article having a side panel formed with a

material that is extensible in the direction (the CD direction) perpendicular to the flow direction of the sheet.

The third patent document discloses a method for producing a worn article having a side panel formed by cutting a material extensible in multi-directions in a non-wasteful manner.

The fourth patent document discloses a method for producing a worn article having a side panel formed with a material stretchable in the CD direction.

DISCLOSURE OF THE INVENTION

[0004] However, extensible sheets are expensive and the side panel is formed by using an extensible sheet in the first patent document, whereby the production cost of the worn article will be high.

Since the stretch of an extensible sheet is smaller than that of an elastic thread, it is not possible to obtain a sufficiently desirable fit.

[0005] Therefore, an object of the present invention is to provide a new worn article, which gives a close fit and with which it is possible to reduce the production cost.

[0006] In the second to fourth patent documents, a side panel using a material extensible in the direction (the CD direction) perpendicular to the flow direction of the sheet is fastened to the absorbent main body portion. When producing a side panel in which the elastic thread is sandwiched between sheets, a material is used that is stretchable in the flow direction of the sheet (the MD

direction). However, the patent documents fail to disclose a production method that uses a material stretchable in the flow direction.

[0007] Another object of the present invention is to provide a new method with which it is possible to produce a worn article having such side panels.

[0008] A worn article of the present invention includes a main body portion including an absorbent core and covering a front torso area, a crotch area and a rear torso area of a wearer, and a pair of side panels attached (fixed) to the main body portion and located between the front and rear torso areas when the worn article is worn, wherein each of the side panels is stretchable in an around-the-torso direction (a direction along a periphery of the torso (waist) of a wearer). At least a portion of the side panel includes an elastic thread sandwiched between at least two sheet-like materials and is in a contracted state where the elastic thread is contracted, thus forming gathers (shirring).

[0009] In this worn article, the elastic thread between the at least two sheet-like materials is shrunk to form gathers in the side panels, and the side panels thereby exhibit substantial stretchability. Therefore, the fit is improved.

Since the side panel is formed by sandwiching an elastic thread between a pair of sheet-like materials, it is possible to reduce the production cost as compared with a case where expensive extensible sheets are used, such as elastic films or extensible non-woven fabric sheets.

[0010] In a preferred embodiment of the worn article of the present invention, a first non-contractile portion where a contractile force from the elastic thread is not active is provided in a portion of the side panel that is joined to the main body portion, and the first non-contractile portion is laid over and attached to the main body portion.

[0011] In a case where such a first non-contractile portion is provided, the first non-contractile portion is not contracted (shrunk) by the contractile force from the elastic thread. Therefore, the flat first non-contractile portion where no gathers are formed can be laid over and joined to the main body portion, thereby facilitating the attachment of the side panels to the main body portion.

[0012] In a further preferred embodiment of the worn article of the present invention, a second non-contractile portion where a contractile force from the elastic thread is not active is provided in a tip portion of the side panel in the around-the-torso direction. A fastening element is attached to the second non-contractile portion, the fastening element being used for fastening the side panels to the main body portion when the worn article is worn.

[0013] In a case where such a second non-contractile portion is provided, the second non-contractile portion is not contracted by the contractile force from the elastic thread. Therefore, the fastening element can be placed while being laid over the flat second non-contractile portion where no gathers are formed, thereby facilitating the attachment of the fastening element to the

side panels.

[0014] A production method for obtaining the worn article of the present invention is a method for producing a worn article in which a pair of side panels each including two sheet-like materials and an elastic member sandwiched between the two sheet-like materials are attached to a main body portion. The production method includes the steps of: feeding an elastic member between a pair of sheet-like materials along a flow direction of the pair of sheet-like materials so as to obtain a laminate to be the side panels; cutting off the laminate at a predetermined interval in the flow direction to obtain cut panels; changing an attitude of a pair of cut panels including two of the cut panels adjacent to each other to an attitude that is obtained by a rotation of about 90 degrees with respect to the flow direction (i.e., the attitude of the pair of cut panels are changed by rotating the pair of cut panels about a normal line perpendicular to the plane of the cut panels so that the longitudinal direction (the stretching direction) of each cut panel is orthogonal to the flow direction); spacing the pair of cut panels apart from each other; and attaching the pair of cut panels to a sheet-like member to be the main body portion, one on a left side and the other on a right side of the sheet-like materials.

[0015] In the present invention, the term "a sheet-like member to be the main body portion" means a member to be the main body portion in a produced worn article, and may be either an uncut member being continuous in the flow direction of the sheet-like member or a member that has been cut in a shape of the main body

portion.

[0016] Another production method for obtaining the worn article of the present invention is a method for producing a worn article in which a pair of side panels each including two sheet-like materials and an elastic member sandwiched between the two sheet-like materials are attached to a main body portion. The production method includes the steps of: feeding an elastic member between a pair of sheet-like materials along a flow direction of the pair of sheet-like materials so as to obtain a laminate to be the side panels; cutting the laminate along a cut-off line (cutting line) extending in the flow direction to produce first and second divided laminates, which are separated from each other in a width direction of the sheet-like materials; cutting each of the first and second divided laminates at a predetermined interval in the flow direction to obtain a left cut panel and a right cut panel; spacing the first and second divided laminates apart from each other in the width direction or spacing the left and right cut panels apart from each other in the width direction; changing an attitude of each cut panel to an attitude that is obtained by a rotation of about 90 degrees with respect to the flow direction (i.e., the attitude of each cut panel is changed by rotating each cut panel about a normal line perpendicular to the plane of the cut panel so that the longitudinal direction (the stretching direction) of each cut panel is orthogonal to the flow direction); and attaching the left cut panel and the right cut panel, whose attitudes have been changed, on a left side and a right side, respectively, of a sheet-like member to be the main body

portion.

[0017] Still another production method for obtaining the worn article of the present invention is a method for producing a worn article in which a pair of side panels each including two sheet-like materials and an elastic member sandwiched between the two sheet-like materials are attached to a main body portion. The production method includes the steps of: feeding an elastic member between a pair of sheet-like materials along a flow direction of the pair of sheet-like materials so as to obtain a laminate to be the side panels; cutting the laminate along a predetermined wave-shaped cut-off line extending in the flow direction to produce first and second divided laminates, which are separated from each other in a width direction of the sheet-like materials; cutting the first divided laminate at a predetermined interval in the flow direction to obtain first cut panels; changing an attitude of a pair of first cut panels including two of the first cut panels adjacent to each other to an attitude that is obtained by a rotation of about 90 degrees with respect to the flow direction; attaching the pair of first cut panels whose attitude has been changed to a sheet-like member to be the main body portion, one on a left side and the other on a right side of the sheet-like member; cutting the second divided laminate at a predetermined interval in the flow direction to obtain second cut panels; changing an attitude of a pair of second cut panels including two of the second cut panels adjacent to each other to an attitude that is obtained by a rotation of about 90 degrees with respect to the flow direction; and attaching the pair of second cut

panels whose attitude has been changed to the sheet-like member to be the main body portion, one on the left side and the other on the right side of the sheet-like member.

[0018] The production method may include a step of spacing a pair of first cut panels apart from each other and/or a step of spacing a pair of second cut panels apart from each other.

[0019] In the present invention, it is preferred that the cut panels are formed without being trimmed. However, the cut panels may be formed by being trimmed.

The term "trimming" means cutting away an unnecessary portion of a member for the purpose of improving the fitting property or the aesthetic quality of the product. The terms "trim", "trim waste", "loss" and "lost portion" refer to a portion to be removed or a portion that has been removed in the trimming process.

[0020] The production method of the present invention may further include a step of attaching a fastening element to the laminate, the fastening element being used for fastening the side panels to the main body portion when the worn article is worn, wherein in the step of cutting the laminate to obtain the cut panels, the fastening element, together with the laminate, is cut into two pieces so that one cut-off fastening element is provided for each cut panel. In other words, a fastening element may be attached to the laminate, and the laminate is cut so that the fastening element is divided into two pieces. Thus, a small fastening element can easily be attached to the cut panel.

The fastening element does not have to be cut when the laminate is cut, or the fastening element may be attached to the cut panel after the laminate is cut.

[0021] In a production method of the present invention, non-contractile portions where a contractile force from the elastic member is not active may be formed in the laminate at a predetermined interval in the flow direction, and, in the step of cutting the laminate to obtain the cut panels, the laminate may be cut along each non-contractile portion so that the non-contractile portion is provided for each cut panel.

Thus, the non-contractile portions are formed in the laminate, and the laminate is cut along each non-contractile portion to obtain the cut panel, whereby it is possible to easily form the above-mentioned first and second non-contractile portions.

The non-contractile portion may be formed by cutting elastic threads with a cutter, or the like, into short pieces at both end portions of the cut panel, after obtaining the cut panel.

[0022] In the present invention, in the step of feeding the elastic material to obtain the laminate to be the side panels, the elastic member may be fed between the pair of sheet-like materials while the elastic member is being extended in the flow direction to produce the laminate, and then the elastic member of the laminate or the cut panels may be relaxed (slackened) so as to form gathers in the laminate or the cut panels.

Thus, it is possible to obtain a side panel having gathers by sandwiching the elastic member being in an extended state

between the sheet-like materials and then relaxing the elastic member in the laminate or the cut panel.

The step of relaxing the elastic member may be performed after obtaining the laminate and before attaching the cut panels to the sheet-like member to be the main body portion. In order to facilitate the production of such a side panel, it is typically preferred to relax the elastic member before the step of cutting the laminate to obtain cut panels.

In the present invention, the elastic thread used as the elastic member may be a polyurethane-based elastic thread, a polystyrene-based elastic thread or a natural rubber-based elastic thread. It is preferred that elastic threads are arranged with a density of three threads per inch or higher in order to realize an appropriate fit. It is preferred that the stress to be caused on the side panel when the side panel is pulled is set to be 0.3 kgf per inch or more.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] FIG. **1(a)** is a schematic plan view showing a worn article in an extended state according to the first embodiment of the present invention, FIG. **1(b)** is a cross-sectional view taken along line Ib-Ib, and FIG. **1(c)** is a cross-sectional view taken along the same line showing a contracted state.

FIG. **2** is a process diagram showing a production process of the first embodiment.

FIG. **3** is a schematic layout diagram showing a production

device of the first embodiment.

FIG. 4 is a process diagram showing a production process of a modified embodiment.

FIG. 5 is a schematic layout diagram showing a production apparatus of the modified embodiment.

FIG. 6 is a schematic plan view showing a worn article in an extended state according to the second embodiment.

FIG. 7 is a process diagram showing a production process of the second embodiment.

FIG. 8 is a process diagram showing a production process of a modified embodiment.

FIG. 9 is a process diagram showing a production process of a modified embodiment.

FIG. 10 is a schematic plan view showing a worn article in an extended state according to the third embodiment.

FIG. 11 is a process diagram showing a production process of the third embodiment.

FIG. 12 is a schematic layout diagram showing a production apparatus of the third embodiment.

FIG. 13 is a process diagram showing a production process of a modified embodiment.

FIGs. 14(a) and 14(b) are schematic perspective views each showing an example of a laminate, and FIG. 14(c) is a schematic perspective view showing a method for producing the laminate of FIG. 14(b).

FIG. 15 is a schematic layout diagram showing a device for

producing the laminate.

FIG. **16** is a perspective view showing an example of an attitude-changing device.

FIG. **17** is a schematic plan view showing an attitude-changing operation.

FIG. **18** is a schematic plan view showing another example of an attitude-changing device.

FIGs. **19(a)** to **19(c)** are schematic plan views each showing still another example of an attitude-changing device.

FIG. **20** is a schematic plan view showing a step of slitting a laminate according to the fourth embodiment.

FIG. **21** is a schematic plan view showing a method for producing cut panels of the fourth embodiment, and showing how the cut panels are rotated and moved.

FIGs. **22(a)** and **22(b)** are schematic plan views showing positions where cut panels of the fourth embodiment are fastened to the main body portion.

FIG. **23** shows a schematic side-view layout of a production apparatus of the fourth embodiment.

DESCRIPTION OF THE REFERENCE NUMERALS

[0024] **25**: Absorbent core

20: Absorbent main body portion

C1: First non-contractile portion

C2: Second non-contractile portion

CD: Width direction

F1: First touch fastener (fastening element)

G: Elastic thread (elastic member)

MD: Flow direction

N1: First divided laminate

N2: Second divided laminate

PL, PR: Side panel

S1: First sheet-like material

S2: Second sheet-like material

W: Laminate

W1: First laminate

W2: Second laminate

WL1, WR1, P1: First cut panel

WL2, WR2, P2: Second cut panel

P3: Third cut panel

P4: Fourth cut panel

BEST MODE FOR CARRYING OUT THE INVENTION

[0025] Embodiments of the present invention will now be described with reference to the drawings.

First, before describing a production method of the present invention, an example of a worn article that can be produced by the production method will be described.

[0026] First embodiment

Worn Article:

FIGs. **1** to **3** show the first embodiment.

FIGs. **1(a)** to **1(c)** show an example of a disposable diaper

of the first embodiment (an example of a worn article). FIG. **1(a)** is a plan view showing a diaper being unfolded and extended, and FIG. **1(b)** is a cross-sectional view taken along line Ib-Ib of FIG. **1(a)**.

As shown in FIG. **1(a)**, the diaper includes an absorbent main body portion **20**, a pair of side panels PL and PR affixed to the main body portion **20**, and a pair of tab members **21** and **21** affixed to the main body portion **20**.

The main body portion **20**, when worn, covers a front torso area (abdominal area), a crotch area and a rear torso area (back area) of the wearer. Corresponding to these areas, the main body portion **20** includes a front torso portion (abdominal portion) **20f**, a crotch portion **20d** and a rear torso portion (back portion) **20b**.

[0027] Side panels PL and PR:

When worn, the side panels PL and PR are each positioned between the front and rear torso portions **20f** and **20b**. The side panels PL and PR are affixed to the left side and the right side, respectively, of an end portion of the main body portion **20** in the longitudinal direction Y. For example, the side panels PL and PR are affixed to the rear torso portion **20b** so as to protrude from the left and right of the rear torso portion **20b** of the main body portion **20**. Alternatively, the side panels PL and PR may be affixed to the front torso portion **20f**.

[0028] The tab members **21** are affixed to the left and right of the front torso portion **20f** of the main body portion **20**. The tab members **21** may be omitted.

[0029] As shown in FIG. **1(b)**, the side panels **PL** and **PR** are formed by an elastic thread (an example of an elastic member) **G** sandwiched between at least two sheet-like materials **S1** and **S2** such as non-woven fabric sheets. As shown in FIG. **1(c)**, where there is no load being applied, the side panels **PL** and **PR** are in a contacted state (shrunk state) with gathers being formed as the elastic thread **G** contracts (shrinks) in the around-the-torso direction **X**.

The term "gathers (shirring)" means the shape of a sheet material being creased and contacted when there is no external force applied thereon, and includes those such as pleats and creases.

Instead of the elastic thread **G**, a film-shaped elastic member may be used as the elastic member for forming the gathers. The elastic member may be any material that can be sandwiched between the sheet-like materials **S1** and **S2** to form the gathers, and the property and the shape thereof are not limited to any particular property and shape.

[0030] The side panels **PL** and **PR** are provided with first and second non-contractile portions **C1** and **C2** where the panels **PL** and **PR** are not contracted (shrunk) by the contractile force from the elastic thread **G**, i.e., where the contractile force from the elastic thread **G** does not act. As shown in FIGs. **14(a)** and **14(b)**, the non-contractile portions **C1** and **C2** are formed, for example, by cutting off the elastic thread **G** with a pressure or by cutting the elastic thread **G** into small pieces with a cutter.

[0031] The first non-contractile portion **C1** shown in FIG. **1** is provided at a portion of each of the side panels **PL** and **PR** where the side panel is joined to the main body portion **20**, and is laid over and affixed to the main body portion **20**. The second non-contractile portion **C2** is provided at a tip portion of each of the side panels **PL** and **PR** in the around-the-torso direction **X**.

[0032] A first touch fastener (an example of the fastening element) **F1** is affixed to the inner surface side (the side to be in contact with the skin when worn) of the tip portion of the second non-contractile portion **C2**. A second touch fastener **F2**, which can be touch-fastened (joined detachably in face contact) to the first touch fastener **F1**, is affixed to the outer surface side (the side to be exposed to the outside when worn) of the main body portion **20** on the front torso portion **20f**. The wearer wears the diaper by putting the side panels **PL** and **PR** around the torso of the wearer while gripping the tab members **21**, and fastening the first touch fasteners **F1** of the side panels **PL** and **PR** to the second touch fastener **F2**.

[0033] The second touch fastener **F2** may be omitted. The touch fasteners may be replaced by an adhesive tape and a portion to be bonded to the adhesive tape.

[0034] Main body portion **20**:

For example, the main body portion **20** includes a pair of cuffs (anti-leak walls) **27** to be in contact with the surface of the wearer, a liquid-permeable topsheet **24**, a liquid-absorbing absorbent core **25**, a liquid-impermeable backsheet **26**, etc.

The main body portion **20** may include a leg elastic member **28** for forming leg gathers, for example. The cuffs **27** may be omitted, or a cuff elastic member **29** for shrinking the cuffs **27** in the Y direction may be provided. The backsheet **26** may be an air-permeable and waterproof sheet. The backsheet **26** may be a stretchable sheet.

The main body portion **20** includes such members layered (stacked) together.

[0035] Production steps:

An example of the step of forming the side panels **PL** and **PR** and bonding them to the main body portion **20** will now be described with reference to FIG. **2**.

[0036] Step of obtaining laminate:

First, the elastic thread **G** being extended is fed (supplied) between a pair of essentially non-stretchable sheet-like materials **S1** and **S2** along the flow direction **MD** of the pair of sheet-like materials **S1** and **S2**, and the elastic thread **G** is sandwiched between the pair of sheet-like materials **S1** and **S2**, thereby obtaining a laminate **W** to be the side panels **PL** and **PR**.

As shown in **(a)** of FIG. **2**, the non-contractile portions **C1** and **C2** are formed on the laminate **W** alternately in the flow direction **MD**. The non-contractile portions **C1** and **C2** are spaced apart from each other. The first touch fastener **F1** is bonded to the second non-contractile portion **C2**. The method for producing the laminate **W** and the method for forming the non-contractile portions will be described later.

While the elastic thread G is used herein as an example of the elastic member, a film-shaped elastic member may be used instead of the elastic thread G. The elastic member to be used instead of the elastic thread G may be any material and the property and shape thereof are not limited to any particular property and shape as long as it can be sandwiched between the sheet-like materials **S1** and **S2** to form gathers.

[0037] Step of obtaining cut panels:

Then, the laminate **W** is cut at a predetermined interval in the flow direction **MD** to thereby obtain cut panels **WL** and **WR** adjacent to each other. In other words, a plurality of cut panels **WL** and **WR** are obtained by repeatedly cutting off a tip portion of the laminate **W**. The laminate **W** is cut off along the non-contractile portions **C1** and **C2**. By such a cutting process, the first touch fastener **F1**, bonded to the second non-contractile portion **C2**, is cut and divided into two together while the laminate **W** is cut off. Therefore, one fastening element is divided into two, whereby the first touch fastener **F1** is provided on each of the cut panels **WL** and **WR**.

The first touch fastener **F1** may be attached to each of the cut panels **WL** and **WR** after the laminate **W** is cut into pieces.

[0038] Step of changing attitude (turning step):

After the cutting process, the attitude of a pair of cut panels consisting of two cut panels **WL** and **WR** adjacent to each other is changed to an attitude (orientation) that is obtained by a rotation of about 90 degrees with respect to the flow direction **MD**,

i.e., the pair of cut panels is turned (pivoted) so that the stretch direction of the cut panel is orthogonal to the flow direction MD, as shown in (b) to (d) of FIG. 2. While the pair of cut panels WL and WR is turned by 90 degrees in the first direction in FIG. 2, the pair of cut panels WL and WR may be turned by 90 degrees in the second direction different from the first direction.

[0039] Spacing step:

Before bonding the cut panels WL and WR (PL and PR) as shown in (h) of FIG. 2, the interval between the pair of cut panels WL and WR and the next pair of cut panels WL and WR in the flow direction MD is increased. It is only required that this spacing step is performed before the fastening step to be described later. For example, this spacing step may be performed simultaneously with, before, or after, the turning step for changing the attitude of the cut panels WL and WR. Alternatively, this spacing step may be performed simultaneously with, or after, the "step of spacing two cut panels from each other" to be described next.

[0040] Step of spacing two cut panels from each other:

Then, unnecessary portions 15 of the cut panels WL and WR are cut away (trimmed) as shown in (f) of FIG. 2, and the pair of cut panels WL and WR are spaced apart from each other in the CD direction generally perpendicular to the flow direction MD as shown in (g) of FIG. 2, thereby obtaining a side panel PL formed by the cut panel WL and a side panel PR formed by the cut panel RL. The trimming may be performed after the side panels PL and PR are bonded to the main body portion 20. The trimming does not

always have to be performed.

[0041] Bonding step:

Then, the first non-contractile portions C1 and C1 of the two side panels PL and PR spaced apart from each other are bonded (affixed) to the left side and the right side, respectively, of the main body portion 20 in the flow direction MD. By this bonding process, the right side panel PR (WR) and the left side panel PL (WL) are provided in the diaper.

[0042] Production method:

An example of the method for producing the diaper will now be described with reference to FIG. 3.

The elastic thread G is introduced between a pair of drawing rolls 31A and 31B shown in FIG. 3. The drawing rolls 31 (31A and 31B) draw the elastic thread G in the flow direction MD. The drawing process is performed by, for example, setting the circumferential velocity of the drawing roll 31B to a value greater than the circumferential velocity of the upstream drawing roll 31A. The draw ratio is preferably set to about 2.0 to 4.5.

Then, the elastic member G being drawn is sandwiched between, and bonded to, non-woven fabric sheets S1 and S2, thus obtaining the laminate W. The bonding can be done by using a hot-melt adhesive, ultrasonic welding, etc. Then, a part of the elastic member G of the laminate W is cut into small pieces by an embossing roll 41, or the like, to deactivate the contraction stress of the part of the elastic member G, thus forming the first and second non-contractile portions C1 and C2.

[0043] Then, the first touch fastener **F1** is bonded to the second non-contractile portion **C2** of the laminate **W** ((**a**)of FIG. **2**). The first touch fastener **F1** is obtained by drawing out a material from a fastener roll **FR** and then cutting the material to a predetermined length by a fastener cutter **32**.

[0044] After the bonding process, the laminate **W** is introduced into a pair of relaxing rolls **33** to form the gathers. The gathers (the portion of each cut panel of FIG. **1** between the first and second non-contractile portions **C1** and **C2**) are formed because of the contraction of the elastic thread **G** of the laminate **W** due to the circumferential velocity of the relaxing rolls **33** being set to a value smaller than the circumferential velocity of the upstream drawing rolls **31**.

[0045] Then, the laminate **W** is cut off by a cutter **34** to obtain the cut panels **WL** and **WR** shown in **(a)** of FIG. **2**.

[0046] After the cutting process, an adjustment drum **35** changes the attitude of a pair of cut panels consisting of two cut panels **WL** and **WR** adjacent to each other to an attitude that is obtained by a rotation of about 90 degrees with respect to the flow direction **MD** (turning step), and increases the interval between the pair of cut panels **WL** and **WR** and the next (subsequent) pair of cut panels **WL** and **WR** (spacing step).

[0047] The drum **35** receives the pair of cut panels **WL** and **WR** onto a pad thereof, and the pad rotates around the drum **35** while increasing the circumferential velocity thereof so as to increase the interval between pads and turning about an axis generally in the

diameter direction of the drum **35**. This increases the interval between pairs of cut panels **WL** and **WR** in the flow direction **MD** while turning each pair of cut panels **WL** and **WR**, as shown in **(b)** to **(e)** of FIG. **2**. Thus, the attitude of the pair of cut panels **WL** and **WR** is changed to an attitude that is obtained by a 90 degrees rotation.

[0048] In a case where the turning step and the spacing step are performed separately, the following structure can be used.

The structure and method for performing the spacing step may be, for example, those disclosed in Japanese Laid-Open Patent Publication No. 2002-345889.

The structure for performing the turning step may be, for example, any of various structures such as those disclosed in Japanese Laid-Open Patent Publication No. 63-317576, Japanese Patent Examined Publication No. 07-051143, and Japanese Laid-Open Patent Publication No. 2003-199790 (Paragraphs 0021 to 0024 and FIG. **2**).

[0049] Then, an interval-increasing device **36** spaces apart each pair of cut panels **WL** and **WR** from each other in the CD direction (**(f)** of FIG. **2**), thus obtaining the side panels **PL** and **PR**.

After this spacing process, the side panels **PL** and **PR** are bonded to the left side and the right side, respectively, of the main body portion **20**, which is supplied from a separate line.

The tab members **21** may be bonded to the main body portion **20** before the bonding of the side panels **PL** and **PR** or may be bonded to the main body portion **20** after the bonding of the side

panels PL and PR.

[0050] Modified embodiment:

Another method for obtaining a diaper of the first embodiment as described above will now be described.

FIGs. 4 and 5 show a modification of the embodiment.

As shown in (a) of FIG. 4, after the first touch fastener F1 is bonded to the second non-contractile portion C2, the laminate W is cut (slit) along a generally straight cut-off line extending in the flow direction MD. Thus, the laminate W is divided into the first and second laminates W1 and W2, which are separated from each other in the width direction CD (the direction generally perpendicular to the flow direction MD). Then, the first and second laminates W1 and W2 are spaced apart from each other in the width direction CD. The first touch fastener F1 may be bonded to each of the laminates W1 and W2 after the slitting process. After the spacing process, the two slit laminates W1 and W2 are cut off at a predetermined interval in the flow direction MD, i.e., repeatedly cutting off a tip portion of each of the laminates W1 and W2, thus obtaining left and right cut panels WL1 and WR1 (WL2 and WR2).

[0051] Then, as shown in (b) to (d) of FIG. 4, each of the cut panels WL1 and WR1 is turned by about 90 degrees, thereby changing the attitude of each of the cut panels WL1 and WR1 to be orthogonal with respect to the flow direction MD. The left and right cut panels WL1 and WR1 are rotated by about 90 degrees in different directions, while increasing the interval between the pair

of left and right cut panels **WL1** and **WR1** and the next pair of left and right cut panels **WL2** and **WR2**.

Then, the spacing step and the bonding step as shown in **(f)** to **(h)** of FIG. **2** are performed.

[0052] As shown in FIGs. **4(f)** to **4(h)**, each of the next pair of cut panels **WL2** and **WR2** are rotated by about 90 degrees in opposite directions to the previous cut panels **WL1** and **WR1**, respectively.

[0053] Production method of the modified embodiment:

As shown in FIG. **5**, after the first touch fastener **F1** is bonded to the laminate **W**, the laminate **W** is cut (slit) by a slitter **37** to obtain the first and second laminates **W1** and **W2** shown in **(a)** of FIG. **4**. Then, the interval between the first and second laminates **W1** and **W2** in the width direction **CD** is increased by the interval-increasing device **36**. In other words, the laminates **W1** and **W2** are spaced apart from each other in the width direction CD.

[0054] There are provided a pair of (two lines of) each of the relaxing rolls **33**, the cutters **34** and the adjustment drums **35** for processing the first and second laminates **W1** and **W2**.

The laminates **W1** and **W2** whose interval has been increased are relaxed by the relaxing rolls **33**, and then cut by the cutters **34**, to produce the cut panels **WL1** and **WR1**.

The adjustment drums **35** increase the interval between the left and right cut panels **WL1** and **WR1** and the next pair of left and right cut panels **WL2** and **WR2**, while rotating the left and right cut panels **WL1** and **WR1** by about 90 degrees in the first and

second directions R1 and R2 ((b) of FIG. 4), respectively, thus changing the attitude of each of the cut panels WL1 and WR1 to be orthogonal with respect to the flow direction MD.

[0055] Then, the adjustment drums 35 increase the interval between the next pair of cut panels WL2 and WR2 and the second next pair of cut panels, while rotating the left and right cut panels WL2 and WR2 by about 90 degrees in the second and first directions R2 and R1, respectively, thus changing the attitude of each of the cut panels WL2 and WR2. The rotation direction R2 of the cut panel WL2 is opposite to the rotation direction R1 of the previous cut panel WL1, and the rotation direction R1 of the cut panel WR2 is opposite to the rotation direction R2 of the previous cut panel WR1. A mechanism for increasing the interval between the cut panels WL1 and WL2 (WR1 and WR2) while rotating the cut panels WL1 and WL2 (WR1 and WR2) in the forward direction and in the reverse direction (in opposite directions) will be described later.

[0056] Second embodiment

FIGs. 6 and 7 show the second embodiment.

In the above-described first embodiment, a trimming process is performed when producing the cut panels to remove the unnecessary portions 15. The second embodiment and subsequent embodiments are directed to methods for producing cut panels that do not require the trimming process (i.e., methods without loss).

As shown in FIG. 6, in the side panels PL1 and PR1 (PL2 and PR2) of the second embodiment, the second non-contractile

portion C2 is cut in a slant direction with respect to the Y direction. Other than this, the embodiment is similar to the first embodiment. Therefore, the same or like elements corresponding to those of the first embodiment will be denoted by the same reference numerals as the first embodiment and will not be further described below.

[0057] Production steps will now be described with reference to FIG. 7.

As shown in (a) of FIG. 7, after the first touch fastener F1 is bonded to the second non-contractile portion C2, the laminate W is cut at a predetermined interval in the flow direction MD, thereby obtaining a pair of cut panels consisting of two cut panels WL1 and WR1 adjacent to each other. The laminate W is cut in the second non-contractile portion C2 along a slant cut-off line that is slant with respect to the width direction CD. The cut-off line of the second non-contractile portion C2 and the cut-off line of another adjacent second non-contractile portion C2 are inclined in opposite directions with respect to a line extending in the width direction CD. Thus, a pair of cut panels WL1 and WR1 and another pair of cut panels WL2 and WR2 upside down of the first pair are formed alternately.

[0058] Then, as shown in (b) to (e) of FIG. 7, after being spaced apart from the subsequent cut panels WL2 and WR2, the cut panels WL1 and WR1 are turned by about 90 degrees, thereby changing the attitude of each of the cut panels WL1 and WR1 to be orthogonal to the flow direction MD. After the turning process, the two cut panels WL1 and WR1 are spaced apart from each other

in the width direction CD as shown in (k) of FIG. 7.

[0059] As shown in (f) to (j) of FIG. 7, the subsequent pair of cut panels **WL2** and **WR2** are also turned by 90 degrees in the same direction, thereby changing the attitude of each of the cut panels **WL2** and **WR2**. Then, the two cut panels **WL2** and **WR2** are spaced apart from each other in the width direction CD.

As shown in (l) of FIG. 7, the interval between a set of two pairs of cut panels **WL1**-**WR1** and **WL2**-**WR2** (**PL1**-**PR1** and **PL2**-**PR2**) and another set of two pairs of cut panels is increased, and then the cut panels are bonded to the main body portion **20**.

[0060] By the bonding process, the right side panels **PR1** and **PR2** (**WR1** and **WR2**) and the left side panels **PL1** and **PL2** (**WL1** and **WL2**) are formed in the diaper.

The apparatus for producing the diaper of the second embodiment may be the production apparatus of FIG. **3**, for example.

[0061] A modification of the second embodiment will now be described.

As shown in FIG. **8**, a pair of cut panels **WL1** and **WR1** and the subsequent pair of cut panels **WL2** and **WR2** may be turned in the opposite directions **R1** and **R2**.

As shown in FIG. **9**, a pair of cut panels **WL1** and **WR1** may be turned by 90 degrees in the first direction **R1**, while turning the subsequent pair of cut panels **WL2** and **WR2** by 270 degrees in the first direction **R1**.

[0062] Third embodiment

FIGs. **10** to **12** show the third embodiment.

As shown in FIG. **10**, with the side panels **PL1** and **PR1** (**PL2** and **PR2**) of the third embodiment, the contractile portion between the first non-contractile portion **C1** and the second non-contractile portion **C2** is partially cut off in a slant direction with respect to the X direction. Thus, the width of each of the two side panels **PL1** and **PR1** in the Y direction gradually decreases (i.e., the height thereof decreases) from the first non-contractile portion **C1** toward the second non-contractile portion **C2**. Other than this, this embodiment is similar to the first embodiment. Therefore, the same or like elements corresponding to those of the first embodiment will be denoted by the same reference numerals as the first embodiment and will not be further described below.

[0063] Production steps will now be described with reference to FIG. **11**.

In the production steps of the diaper of the third embodiment, two processing lines are used to produce two pairs of cut panels each time as will be described below.

As shown in **(a)** of FIG. **11**, after the first touch fastener **F1** is bonded to the second non-contractile portion **C2**, the laminate **W** is cut along the cut-off line extending in the flow direction **MD**, thereby obtaining the first and second laminates **W1** and **W2**, which are separated from each other in the width direction **CD**. The laminate **W** is slit (i.e., divided in the width direction) along a predetermined wave-shaped cut-off line extending in the flow direction **MD** such that peaks and troughs alternate with each

other. Then, the first and second laminates **W1** and **W2**, which have been separated from each other, are spaced apart from each other in the width direction **CD**. While the cut-off line in FIG. **11** has an angular wave shape, the cut-off line may be a smoothly continuous and generally S-shaped wavy line.

By slitting the material along a wave shape (generally S-letter shape), it is possible to obtain a disposable diaper with an improved fit and an improved aesthetic quality with little or no trim waste (loss).

[0064] After the spacing process, the laminates **W1** and **W2**, which have been formed by slitting the material into two, are cut off at a predetermined interval in the flow direction **MD** (i.e., repeatedly cutting off a tip portion of each of the laminates **W1** and **W2**), thereby obtaining a pair of cut panels **WL1** and **WR1** (**WL2** and **WR2**) consisting of two cut panels adjacent to each other as shown in **(b)** of FIG. **11**. In this process, each pair of cut panels are separated (divided) at the second non-contractile portion **C2** forming the trough portion from the subsequent pair of cut panels. Thus, in a pair of cut panels **WL1** and **WR1** (**WL2** and **WR2**), the first non-contractile portions **C1** and **C1** forming the peak portion, are adjacent to each other. Therefore, the up-down orientation of a pair of first cut panels **WL1** and **WR1** produced from the first laminate **W1** is opposite to that of a pair of second cut panels **WL2** and **WR2** produced from the second laminate **W2**. Specifically, the first cut panels **WL1** and **WR1** are positioned so that the peak portion of the first cut panels **WL1** and **WR1** is facing downward in

(a) of FIG. 11, and the second cut panels WL2 and WR2 are positioned so that the peak portion of the second cut panels WL2 and WR2 is facing upward in (a) of FIG. 11.

[0065] Then, as shown in (c) to (g) of FIG. 11, the interval between the pair of first cut panels WL1 and WR1 and the subsequent pair of first cut panels is increased, and the pair of first cut panels WL1 and WR1 are turned by about 90 degrees, thereby changing the attitude thereof to be orthogonal to the flow direction MD. In this process, the first cut panels WL1 and WR1 are turned in the first direction R1. After the turning process, the two first cut panels WL1 and WR1 are spaced apart from each other in the width direction CD as shown in (m) of FIG. 11. After this spacing process, the first cut panels WL1 and WR1 (PL1 and PR1) are bonded to the main body portion 20 as shown in (n) of FIG. 11.

[0066] As shown in (h) to (l) of FIG. 11, the interval between the pair of second cut panels WL2 and WR2 and the subsequent pair of cut panels is increased, and the pair of second cut panels WL2 and WR2 are turned by about 90 degrees in the second direction R2, which is opposite to the turning direction R1 of the pair of the first cut panels WL1 and WR1. After the turning process, the two second cut panels WL2 and WR2 are spaced apart from each other in the width direction CD as shown in (o) of FIG. 11. After this spacing process, the second cut panels WL2 and WR2 (PL2 and PR2) are bonded to the main body portion 20 as shown in (n) of FIG. 11.

[0067] A method for producing a diaper of the present

embodiment will now be described briefly with reference to FIG. 12.

As shown in FIG. 12, after the first touch fastener F1 is bonded to the laminate W, the laminate W is slit by the slitter 37, thereby obtaining the first and second laminates W1 and W2 shown in (a) of FIG. 11. Then, a first interval-increasing device 36 increases the interval between the first and second laminates W1 and W2 in the width direction CD.

[0068] As shown in FIG. 12, there are provided a pair of (two lines of) each of the slackening rolls 33, the cutters 34 and the adjustment drums 35.

In the first line, the first laminate W1, which has been spaced away from the second laminate W2, is relaxed by the relaxing rolls 33, and then cut by the cutter 34, to produce the first cut panels WL1 and WR1.

[0069] Then, the adjustment drum 35 increases the interval between a pair of first cut panels WL1 and WR1 and the next pair of cut panels, and rotates the pair of first cut panels WL1 and WR1 by about 90 degrees in the first direction R1, thus changing the attitude thereof to be orthogonal to the flow direction MD. After the interval between the first cut panels WL1 and WR1 is increased by a second interval-increasing device 38, the first cut panels WL1 and WR1 are bonded to the main body portion 20.

[0070] In the second line, a similar processing to that of the first laminate W1 is performed for the second laminate W2 to produce the second cut panels WL2 and WR2, which are then bonded to the main body portion 20. The adjustment drum 35 increases the

interval between a pair of second cut panels **WL2** and **WR2** and the next pair of second cut panels, while rotating the pair of second cut panels **WL2** and **WR2** by about 90 degrees in the second direction **R2**, which is opposite to the rotation direction **R1** of the pair of the first cut panels **WL1** and **WR1**, thus changing the attitude thereof.

[0071] FIG. **13** shows a modification.

As shown **(m)** of in FIG. **13**, the pair of the first cut panels **WL1** and **WR1** may be moved to the line of the pair of the second cut panels **WL2** and **WR2** so as to align both pairs of cut panels with each other. Such movement may be realized by, for example, moving pads, which carry cut panels thereon, around a drum.

Steps of **(a)** to **(l)** of FIG. **13** are similar to those of **(a)** to **(l)** of FIG. **11**, and will not be further described below.

[0072] Method for producing laminate **W**:

A method for producing the laminate **W** will now be described.

The laminate **W** shown in FIG. **14(a)** includes the non-stretchable portions **C1** and **C2** where the elastic thread **G** between the sheet-like materials **S1** and **S2** has been cut off by an embossing process.

Such a laminate **W** is produced in the following way: first, the sheet-like materials **S1** and **S2** are bonded together with the elastic thread **G** in an extended state being sandwiched therebetween; then, only the elastic thread **G** is cut off by performing an embossing process with the emboss roll heated to room temperature or a predetermined temperature, or by using a

cutter, or the like. Portions where the elastic thread G is cut off by the embossing process, or the like, become the non-stretchable portions C1 and C2.

[0073] The laminate W shown in FIG. 14(b) can be produced by, for example, a production device shown in FIG. 15.

The production device shown in FIG. 15 includes a rotating device 1 capable of relaxing the second sheet-like material S2, and a second roll 12 capable of placing the elastic thread G in a portion other than a portion where the second sheet-like material S2 is relaxed. The elastic thread G extending over a slack portion of the second sheet-like material S2 is cut off by a cutter C4 of FIG. 15, e.g., at least one of laser, industrial light, a blade and scissors, after it is placed so as to extend over the slack portion as shown in FIG. 14(c). Thus, the present device is capable of placing the elastic thread G intermittently onto the second sheet-like material S2. The intermittent pattern is caused primarily by the slack of the second sheet-like material S2.

[0074] In FIG. 15, the elastic thread G of a first roll GR is fed to the second roll 12. The circumferential velocity V2 of the second roll 12 is set to a value larger than the circumferential velocity V1 of the first roll GR. Thus, the elastic thread G is extended between the first roll GR and the second roll 12.

[0075] The first sheet-like material S1 is fed to the second roll 12. The second roll 12 carries the first sheet-like material S1 while sucking it by a vacuum, or the like. The surface of the second roll 12 may include, for example, many suction holes 12a for sucking

the first sheet-like material **S1**. After the first sheet-like material **S1** is sucked and held on the surface of the second roll **12** by a vacuum, or the like, the first sheet-like material **S1** is divided into pieces of a predetermined size by a web cutter 2.

After the division process, the elastic thread G is placed so as to extend over the surface of the divided first sheet-like material **S1**. An adhesive is applied on at least one of the elastic thread G, the first sheet-like material **S1** and the second sheet-like material **S2**.

[0076] The rotating device 1 for performing a folding process is placed near the second roll **12**.

The rotating device 1 includes a plurality of pads **9i** capable of sucking the second sheet-like materials **S2** and carrying the second sheet-like materials **S2**. Suction holes **10** for sucking the second sheet-like material **S2** are provided on the surface of each pad **9i**. The rotating device 1 continuously carries sheet-like materials. The first sheet-like material **S1**, the elastic thread G and the second sheet-like material **S2** are in contact with one another at the contact point O, thus producing the laminate **W**.

[0077] At the receiving position **RP**, the rotating device 1 receives the second sheet-like material **S2** at the velocity **V11**. At the point A where a pad **9i** receives the second sheet-like material **S2**, the circumferential velocity of the pad is **V11**. The rotation velocity of each pad **9i**, which is the velocity **V11** at the point **A**, is decreased to the velocity **V21** while the pad **9i** moves toward the contact point O. Therefore, the interval between the pads **9i** is decreased from the

receiving position **RP** to the contact point O. Thus, the second sheet-like material **S2** is slackened between the pads **9i** to form a slack portion **Sa**.

[0078] Attitude-changing device:

A device and method for the attitude-changing process will now be described.

In FIG. **16**, an attitude-changing device **80** includes first moving sections **81** and second moving sections **82** in an alternating pattern on an adjustment drum (not shown). The adjustment drum is provided with a guide groove **83** shown in FIGs. **17(a)** to **17(e)**.

[0079] In FIG. **16**, the first and second moving sections **81** and **82** each have a pad base **84** rotating in the circumferential direction of the adjustment drum. A drive pulley **85** and a driven pulley **86** are rotatably provided on the pad base **84**. A timing belt **87** is wound around the pulleys **85** and **86**. A circumscribed pulley **88A** is engaged with the timing belt **87** of the first moving section **81**, and an inscribed pulley **88B** is engaged with the timing belt **87** of the second moving section **82**. First and second pads **89A** and **89B** are mounted on the circumscribed pulley **88A** and the inscribed pulley **88B**, respectively.

[0080] As shown in FIG. **17(a)**, the drive pulley **85** is provided with a cam follower **85c**, whereby as the moving sections **81** and **82** rotate in the circumferential direction of the adjustment drum, the drive pulley **85** rotates in a slant section **83a** of the guide groove **83**. Along with the rotation of the drive pulley **85**, the circumscribed

pulley **88A** rotates in the first direction **R1** as shown in FIGs. **17(a)** to **17(c)**, and the first pad **89A** of FIG. **5** on the pulley **88A** turns by 90 degrees in the first direction **R1**. Thus, the attitude of the first group of panels **WL1** to **WR1** is changed to an attitude that is obtained by a 90 degrees rotation in the first direction **R1**.

[0081] Along with the rotation of the driven pulley **85**, the inscribed pulley **88B** rotates in the second direction **R2** as shown in FIGs. **17(c)** to **17(e)**, and the second pad **89B** of FIG. **5** on the pulley **88B** turns by 90 degrees in the second direction **R2**. Thus, the attitude of the second group of panels **WL2** to **WR2** is changed by 90 degrees in the second direction **R2**.

[0082] Another attitude-changing device and method will now be described.

As shown in FIG. **18**, the first and second moving sections **81** and **82** include first and second circumscribed pulleys **88A** and **88C**, respectively. The outer diameter ratio between the first circumscribed pulley **88A** and the second circumscribed pulley **88C** is set to 3:1. Therefore, in the slant section **83a**, the first circumscribed pulley **88A** rotates by 90 degrees in the first direction, whereas the inscribed pulley **88B** rotates by 270 degrees in the first direction in the same slant section **83a**. Thus, two groups of panels **WL1**-**WR1** and **WL2**-**WR2** are rotated so that their attitudes will be the same.

[0083] In order to perform the attitude-changing process shown in FIGs. **16** to **18**, the core sections need to be spaced apart from each other in advance.

[0084] FIGs. **19(a)** to **19(c)** show still another attitude-changing device and method.

In this embodiment, the cut panels are aligned with each other while changing the attitudes thereof, as shown in FIGs. **19(a)** to **19(c)**. The present embodiment will now be described briefly.

[0085] In FIG. **19(a)**, the first and second moving sections **81** and **82** each include the pad base **84**. Opposite ends of the timing belt **87** are fixed on the pad base **84**. The first and second circumscribed pulleys **88A** and **88B** are engaged with the timing belt **87**. The first pad **89A** and the second pad **89B** are mounted on the first circumscribed pulley **88A** of the first moving section **81** and the second circumscribed pulley **88B** of the second moving section **82**, respectively.

[0086] The circumscribed pulleys **88A** and **88B** can reciprocate in the width direction CD generally perpendicular to the moving direction MD of the pad base **84**, and rotate in the forward direction and in the reverse direction as they reciprocate in the CD direction. Therefore, the first pad **89A** on the circumscribed pulley **88A** rotates in the first rotation direction **101** as it moves in the first width direction **CD1** coming closer to the center line **100**, and the second pad **89B** on the second circumscribed pulley **88B** rotates in the second rotation direction **102** as it moves in the second width direction **CD2** coming closer to the center line **100**. The first width direction **CD1** is a direction opposite to the second width direction **CD2**, and the first rotation direction **101** is a direction opposite to the second rotation direction **102**.

[0087] An example of an attitude-changing and alignment method of the present embodiment will now be described.

In the present embodiment, the first cut panels **WL1** and **WR1** and the second cut panels **WL2** and **WR2** on the pads **89A** and **89B** as shown in FIG. **19(a)** transition from a state where they are spaced apart from each other both in the **CD** direction and in the **MD** direction to a state where they are aligned in the flow direction **MD** as shown in FIG. **19(c)**. Specifically, through the attitude-changing process and the movement in the **CD** direction, the panels transition from a state where the first cut panels **WL1** and **WR1** and the second cut panels **WL2** and **WR2** are apart from each other in the **CD** direction and are also apart from each other in the **MD** direction as shown in **(c)** and **(h)** of FIG. **13** to a state where they are aligned with each other as shown in **(m)** of FIG. **13**.

[0088] This will be described in greater detail. As shown in FIGs. **19(a)** to **19(c)**, the first pad **89A** rotates, together with the circumscribed pulley **88A**, by about 90 degrees in the first rotation direction **101**, while the first pad **89A** is carried in the flow direction **MD** to move in the first width direction **CD1** to the position of the center line **100**. The second pad **89B** rotates, together with the second circumscribed pulley **88B**, by about 90 degrees in the second rotation direction **102**, while the second pad **89B** is carried in the flow direction **MD** to move in the second width direction **CD2** to the position of the center line **100**. Thus, the first cut panels **WL1** and **WR1** on the pad **89A** and the second cut panels **WL2** and **WR2** on the pad **89B** are aligned with each other. The

movement of the first pad **89A** and the second pad **89B** in the width direction CD is guided by a cam mechanism (not shown), or the like.

[0089] Fourth embodiment

Another example of a method for producing the diaper of FIG. **1(a)** will now be described.

(a) of FIG. **20** shows the laminate **W**. The method for producing the laminate **W** may be the above-described method for producing the laminate **W**, and will not be further described below. Other than the above-described production method, the following method may be used, for example. Slack portions may be provided on both of two sheet-like materials, and the elastic member G may be introduced between the two sheet-like materials. In this method, gathers (shirring) can be formed by pulling the portion sandwiched between the slack portions to remove the slack of the slack portions.

In the fourth embodiment, the elastic member **G** is provided as in the first embodiment, but it is not illustrated in the figure.

[0090] As shown of **(b)** in FIG. **20**, the laminate **W** is cut off along a wave-shaped cut-off line **CL** while being carried. For example, the cut-off line **CL** is in a wave shape extending in the flow direction **MD** and having a predetermined wavelength. By the cutting process, the laminate **W** is divided into first and second divided laminates **N1** and **N2** having generally the same shape with their phases being shifted from each other (i.e. the laminates

N1 and N2 being out of phase) in the flow direction MD by one half the wavelength.

[0091] After the division process, the first and second divided laminates N1 and N2 are spaced apart from each other in the up-down direction Z (the direction perpendicular to the surfaces of the divided laminates N1 and N2) of FIG. 23. After the spacing process, the first divided laminate N1 is carried while being moved slightly toward the center line 100 as shown in (a) of FIG. 21. Thus, the first divided laminate N1 is carried along the center line 100. The first divided laminate N1 is carried while its attitude being in symmetry with that of the second divided laminate N2 shown in (b) of FIG. 21.

[0092] First and second cut panels P1 and P2:

Then, as shown in (a) of FIG. 21, a tip portion of the first divided laminate N1, among the first and second divided laminates N1 and N2, is cut off to a predetermined length along the cut-off line 101 extending in the width direction CD. By repeating the cutting process, there are produced, for every iteration of one wavelength λ(lambda), first and second cut panels P1 and P2 being generally in line symmetry with each other with respect to the cut-off line 101 therebetween.

[0093] In the laminate W shown in (a) of FIG. 21, the tension in the flow direction MD has been removed, and the extended elastic member is contracting in the flow direction MD, thereby forming gathers in a contractile portion H. The laminate W of such a contracted state is cut off along the cut-off line 101, thereby

producing, from the non-contractile portion C, the bond portions C1 and C1 being wider in the width direction CD, and the fastening portions C2 and C2 on which the touch fastener F is attached.

Therefore, in the first and second cut panels P1 and P2 formed by the cutting process, the contractile portion H of the gathers is produced between the flat bonded portion C1 and the flat fastening portion C2.

[0094] After being cut off, the first and second cut panels P1 and P2 are spaced apart from each other in the flow direction MD. The first and second cut panels P1 and P2 are rotated by about 90 degrees in the same direction, whereby the attitudes thereof change, and the distance between the first cut panel P1 and the second cut panel P2 in the width direction CD is increased.

[0095] After the rotation process, the cut panels P1 and P2 are spaced apart from each other so that the distance between the first cut panel P1 and the second cut panel P2 in the flow direction MD becomes equal to the length of the main body portion 21 or 22 in the flow direction MD as shown in FIG. 22(a). Then, the bond portions C1 and C1 of the first and second cut panels P1 and P2 are bonded to a sheet-like member (hereinafter referred to as the "main body sheet") CW to be the first and second main body portions 21 and 22.

[0096] The main body sheet CW is continuously carried in the flow direction MD. For example, after the bonding of the third and fourth cut panels to be described later, the main body sheet CW is cut along the cut-off line 201 to form the main body portions

21 and 22. By this cutting process, the first main body portion 21 and the second main body portion 22 are produced from the main body sheet CW. Therefore, it can be said that a portion of the main body sheet CW to be the first main body portion 21 and a portion thereof to be the second main body portion 22 are carried alternately.

[0097] The first cut panel P1 is bonded to the first side CS1 of a portion of the main body sheet CW to be the first main body portion 21. The second cut panel P2 is bonded to the second side CS2 of a portion of the main body sheet CW to be the second main body portion 22.

[0098] Third and fourth cut panels P3 and P4:

As with the first divided laminate N1, a tip portion of the second divided laminate N2 is repeatedly cut off, thus producing, for every iteration of one wavelength λ(lambda), third and fourth cut panels P3 and P4 being generally in line symmetry with each other, as shown in (b) of FIG. 21.

After being cut off, the third and fourth cut panels P3 and P4 are spaced apart from each other in the flow direction MD. The third and fourth cut panels P3 and P4 are rotated by about 90 degrees in the same direction, whereby the attitudes thereof change, and the distance between the third cut panel P3 and the fourth cut panel P4 in the width direction CD is increased.

[0099] After the rotation process, the cut panels P3 and P4 are spaced apart from each other so that the distance between the third cut panel P3 and the fourth cut panel P4 in the flow direction MD

becomes equal to the length of the main body portion 21 or 22 in the flow direction MD as shown in FIG. 22(b). Then, the bond portions C1 and C1 of the third and fourth cut panels P3 and P4 are bonded to the first and second main body portions 21 and 22, respectively, of the main body sheet CW.

[0100] As shown in FIG. 22(b), the first cut panel P1 and the fourth cut panel P4 are aligned with each other in the flow direction MD of the main body sheet CW. The second cut panel P2 and the third cut panel P3 are aligned with each other in the flow direction MD of the main body sheet CW. Therefore, the third and fourth cut panels P3 and P4 are positioned so as to oppose the first and second cut panels P1 and P2, respectively, via the center line 100 therebetween.

[0101] The third cut panel P3 is bonded to the second side CS2 of a portion of the main body sheet CW to be the first main body portion 21. The fourth cut panel P4 is bonded to the first side CS1 of a portion of the main body sheet CW to be the second main body portion 22.

[0102] Then, the main body sheet CW is cut into a predetermined shape to produce a diaper as shown in FIG. 1(a). Therefore, a diaper in which the first cut panel P1 and the third cut panel P3 are bonded to the first main body portion 21 and a diaper in which the second cut panel P2 and the fourth cut panel P4 are bonded to the second main body portion 22 are produced alternately.

[0103] The method for placing the cut panels P1 to P4 may be such that the first cut panel P1 is bonded on one side of the main

body sheet CW to be the main body portion 21 (22), and the second or third cut panel P2 or P3 is bonded on a side of the main body sheet CW to be the main body portion that is opposite to the side on which the first cut panel P1 is bonded.

The fourth cut panel P4 may be bonded on either the left side or the right side of the main body sheet CW to be the main body portion 21 (22), and the third or second cut panel P3 or P2 may be bonded on a side of the main body sheet CW to be the main body portion 21 (22) that is opposite to the side on which the fourth cut panel P4 is bonded.

[0104] An underpants-type worn article may be formed by bonding the fastening portion C2 of the side panels P1 and P3 (P2 and P4) of FIG. 22(b) to the main body portion 21 (22). In such a case, the touch fastener F does not have to be provided in the fastening portion C2.

[0105] Production device:

An apparatus for producing the diaper of the present invention will now be described.

As shown in FIG. 23, the laminate W, which is produced by the method and the device described above, is introduced into a slitter 220 to be slit, thus producing the first and second divided laminates (an example of the first and second divided sheets) N1 and N2.

[0106] After the slitting process, the first divided laminate N1 is carried while being slightly moved by a web guider 219 in the width direction toward the center line 100 ((a) of FIG. 21), so as to be

introduced into a first adjustment cutter **231**. The second divided laminate **N2** is carried above the first divided laminate **N1**, so as to be introduced into a second adjustment cutter **232**.

[0107] A tip portion of the first divided laminate **N1** is cut by a cutter **230b** of the first adjustment cutter **231** along the cut-off line **101** (**(a)** of FIG. **21**). The cut panels **P1** and **P2** produced by the cutting process are slightly spaced apart in the flow direction **MD** with respect to the uncut first divided laminate **N1**.

[0108] The first adjustment cutter **231** includes a carrying drum **230a** for sucking and carrying a tip portion of the first divided laminate **N1**, and the cutter **230b**. The circumferential velocity **V21** of each pad (not shown) provided on the carrying drum **230a** is varied periodically. Specifically, each pad of the carrying drum **230a** is decelerated after receiving the first divided laminate **N1** at the upstream side at the carrying velocity V11 of the first divided laminate **N1**. With the provision of the deceleration process, the elastic member of a portion to be the gathers of the side panel may contract.

After the tip portion of the first divided laminate **N1** is cut by the cutter **230b** along the cut-off line **101** (**(a)** of FIG. **21**), the side panels **P1** and **P2**, produced by the cutting process, are carried to the downstream side by the carrying drum **230a**. Pads may be accelerated while carrying the side panels **P1** and **P2** to the downstream side so that the side panel **P1** and the next side panel **P2** are spaced apart from each other and the side panel **P2** and the next side panel **P1** are spaced apart from each other in the flow

direction **MD**.

[0109] First interval-increasing and rotating device **241**:

The cut panels **P1** and **P2**, produced by the cutting process, are transferred to a first interval-increasing and rotating device **241** downstream.

The first interval-increasing and rotating device **241** is a device for spacing the first and second cut panels **P1** and **P2** apart from each other while rotating each of them by 90 degrees, as shown in **(a)** of FIG. **21**. The first interval-increasing and rotating device **241** includes a plurality of pads spaced apart from each other. After the pads receive the cut panels **P1** and **P2** from the first adjustment cutter **231** at the receiving position **RP4**, the pads moves while sucking and hold the cut panels **P1** and **P2** thereon, and then hand over the cut panels **P1** and **P2** to a first interval adjustment device **271** downstream at the hand-over position **SP4**.

[0110] As the pads of the first interval-increasing and rotating device **241** rotate from the receiving position **RP4** to the hand-over position **SP4**, the interval between the pads increases, thus increasing the interval between the cut panels **P1** and **P2** in the flow direction **MD**. At the same time, the pads rotate by about 90 degrees in the same direction, thereby changing the attitudes thereof, and move significantly in the width direction **CD**. Thus, the interval between the first cut panel **P1** and the second cut panel **P2** is increased, while changing the attitudes of the cut panels **P1** and **P2** (**(a)** of FIG. **21**).

[0111] After the process of increasing the interval between cut

panels and changing the attitudes thereof, the interval between the first cut panels P1 and P1 is further increased by the first interval adjustment device 271 downstream. Therefore, the pitch of the first cut panels P1 and P1 of FIG. 22(b) is adjusted to twice the product length Lc. Thus, the positions at which the cut panels are bonded to the main body sheet CW are adjusted and an adhesive is applied by an application device G7. Then, the cut panels P1 and P2 are bonded to the main body sheet CW at predetermined positions (FIG. 22(a)).

The pitch of the second cut panels P2 and P2 of FIG. 22(b) in the flow direction MD is also adjusted to twice the length Lc of the main body portion in the flow direction MD.

The interval adjustment device 271 may be, for example, a drum including a plurality of pads.

[0112] As with the first divided laminate N1, the second divided laminate N2 is subjected to the cutting process, the interval adjustment process and the rotation and interval-increasing process shown in (b) of FIG. 21 by the second adjustment cutter 232, a second interval-increasing and rotating device 242 and a second adjustment device 272, after which the third and fourth cut panels P3 and P4 are bonded to the main body sheet CW at predetermined positions as shown in FIG. 22(b). The second adjustment cutter 232, the second interval-increasing and rotating device 242 and the second interval adjustment device 272 have similar functions to those of the first adjustment cutter 231, the first interval-increasing and rotating device 241 and the first interval

adjustment device **271** for the production and the adjustment of the third and fourth cut panels **P3** and **P4**.

[0113] Thus, with the first and second interval adjustment devices **271** and **272**, the cut panels **P1** to **P4** are placed at predetermined positions of the main body sheet **CW** to be side panels, thus producing a diaper as shown in FIG. **1(a)**.

[0114] While preferred embodiments of the present invention have been described above with reference to the drawings, obvious variations and modifications will readily occur to those skilled in the art upon reading the present specification.

For example, the shape of a cut panel is not limited to a trapezoidal shape or a wave shape.

The main body portion is only required to include an absorbent core, and is not limited to any particular embodiment with respect to the shape thereof, how different sheets are layered, etc.

Thus, such variations and modifications shall fall within the scope of the present invention as defined by the appended claims.

INDUSTRIAL APPLICABILITY

[0115] The present invention is applicable to disposable diapers and underpants.